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NUCLEAR SCIENCE ABSTRACTS

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ABSORPTION AND SCATTERING OF RADIATION

1045 Range Distribution of the Charged Particles from the D-D Reactions for 10 Mev Deuterons: Differential Elastic Scattering Cross Section at 40 Degrees, 60 Degrees, and 80 Degrees in the Center of Mass System by Louis Rosen, Francis K Tallmadge and John H Williams. AECD-2471 (LADC-601) nd Decl Feb 4 1949 19p Proposed for publication in Phys Rev

Microphotographic techniques have been used to obtain the range distribution of the charged particles resulting from the D-D reactions at center of mass angles of 40°, 60° and 80° for 10 Mev deuterons. At 80°, all of the groups of charged particles from the above reactions are clearly resolved. The differential D-D elastic scattering cross sections have been obtained for the same angles, and for these angles, the cross sections per unit solid angle in the center of mass system are in the ratios of 1.00: 0.51: 0.42, respectively.

1046 On the Analysis of Nucleon-Nucleon Scattering Experiments by Geoffrey F Chew, Marvin L Goldberger. AECU-94 (UCRL-272) nd 22p

A method of perturbation calculation, especially adapted to nucleon-nucleon scattering problems, is described. Any contribution to the energy of the system which is relatively small where the nuclear potential is large may be treated as the perturbation. Two principal examples are discussed. (1) Energy as the perturbation: an expansion of the phase shifts in powers of the energy, which extends earlier results. (2) The coulomb field as the perturbation in the proton-proton problem: Expansions are given which relate the nuclear phase shifts in a combined nuclear and coulomb field to the corresponding phase shifts for a purely nuclear problem. Attention is confined to central forces throughout.

1047 Continuous γ-Emission in Neutron-Proton Collisions by M Krook Proc Phys Soc 62A 19-26 (1949) Jan 1

The cross-section for bremsstrahlung in neutron-proton collisions is calculated with a central exchange-force model and for energies up to 20 Mev. Its value is found to lie between 10^{-28} and 10^{-29} cm^2. This probably is too small to be measured with experimental techniques at present available.

1048 Multiple Scattering with Energy Loss by Leslie L Foldy Phys Rev 75 311-312 (1949) Jan 15 (Letter to the editor)

Formulas for the mean-square projected scattering angle and the mean-square project transverse displacement for a particle which has traversed a given thickness of material, taking into account the energy loss by ionization, have been previously used by Eyges [Phys Rev 74 1534 (1948)]. The author appends a reformulation which is more suitable for application to particle mass determinations; in addition, some numerical calculations for Ilford C_2 emulsions (which are shown in the form of curves) are given.

1049 On the Anisotropy of Proton-Proton Scattering at 14.5 Mev by J Leite Lopes Anais Acad Brasil Cienc 20 69-73 (1948)

The experimental data obtained by Wilson and co-workers [Phys Rev 71 384 (1947); Phys Rev 71 560 (1947)] for the angular distribution of the proton-proton scattering at 14.5 Mev are compared with the results of the author's computations based on the symmetrical meson theory of nuclear forces. Assuming the Møller-Rosenfeld potential energy of two nucleons, it is found that the potential in the S state is attractive, while the P-potential is repulsive. Assuming further the first Born approximation, the angular distribution of the 14.5 Mev proton-proton scattering is calculated for different meson masses. The distribution which agrees best with the experiment is that which corresponds to a meson mass 250 m (m is the electron mass).

1050 On the Theory of the Diffusion of Resonance Radiation (K teorii diffusii resonansnogo izluchenia) by L M Biberman Zhur Eksptl i Teoret Fiz 17 416-426 (1947) (In Russian)

Qualitative dissimilarities between radiation diffusion and diffusion of particles are pointed out. It is shown that the differential equation of diffusion is not adequate for the phenomenon considered.

ABSORPTION AND SCATTERING OF RADIATION (continued)

An integral equation is deduced, representing the diffusion of resonance radiation through a layer of absorbing gas. This equation may be solved by approximate methods in the case of lines of the Doppler form. A distribution of excited atoms is obtained depending on the coordinates, optical density and extinction. The evaluation of experiments made by Zemansky and Bates results in values of effective cross sections for the extinction of mercury radiation of 2537 A by H_2, O_2 and N_2 molecules.

1051 The Scattering of High Velocity Neutral Particles by I Amdur, C F Glick and H Pearlman Proc Amer Acad Arts Sci 76 101-119 (1948) Oct

An apparatus is described for producing and scattering high velocity neutral particle beams with energies of 200 to 2000 electron volts. Special features of the apparatus include the use of detectors with small angular apertures, as low as 28.9 seconds of arc, isolation of the scattering gas in a small fraction of the distance between beam source and detector in order to define the angular aperture more sharply, and facilities for accurately probing the beam to obtain measurements of intensity as a function of angle. Extended tests of the apparatus have been made and performance characteristics of vital sections are given to illustrate the quality of control of which the apparatus is capable and the range of variables which can be covered. Typical preliminary results for 1000 and 1200 volt helium atoms scattered in helium are presented and analyzed. It is concluded that the present apparatus is capable of supplying scattering information of the same high quality as that available for thermal velocity beams.

ATOMIC BOMBS AND WARFARE

1052 The Atom Bomb--Two Conceptions Popular Mech 91 148-149 (1949) Feb

Drawings and diagrams are shown illustrating two conceptions of the construction and control of the atom bomb; the source of one of the designs is the British scientist A. R. Weyl, whereas the other is based on an article published in the Russian zone of Germany.

ATOMIC POWER AND PILES

1053 Nuclear Reactor at Brookhaven National Laboratory by L B Borst, M Fox, D Gurinsky, I Kaplan, C Williams and W E Winsche. AECU-73 (BNL) nd 2p

An article based on this document has been published in Phys Rev 74 1883-1884 (1948) Dec 15. An abstract of the article appeared in Nuclear Science Abstracts as Abstract No. II-393.

1054 Atoms, Rockets and the Moon, by Dinsmore Alter. Griffith Observatory Los Angeles 1947 44p

Following an outline of the history of atomic knowledge, the development of the cyclotron is related and the 184-inch synchro-cyclotron at the Radiation Laboratory of California is described. Also treated are automatic disintegration of atoms, peacetime uses of atomic power, the possibilities of travel to and living on the moon and of travel in space.

BIOLOGICAL EFFECTS OF RADIATION

1055 The Genetic Effects of Low Intensity Irradiation by D E Uphoff and Curt Stern. AECU-93 (UCRL-255) Dec 15 1948 5p

In contrast to previous findings no significant difference in mutation rates in the sperm of Drosophila melanogaster was obtained between controls and experimentals which had been subjected to a dose of 52.5 r in gamma rays administered continuously for 21 days at a rate of 2.5 r per day. This unexpected result required further tests. After consideration of various factors the following were regarded as possible causes for the apparent inactivity of irradiation in the experiment: low sensitivity to irradiation of aged sperm, dependence of induced mutation frequency at low dosages on a time factor, and errors of sampling which might have obscured a true difference between control and experimental rates. Three new tests which are described gave an increased frequency of mutations in the

BIOLOGICAL EFFECTS OF RADIATION (continued)

treated sperm as opposed to the controls. Viewing all experiments together, it appeared that irradiation at low dosages, administered at low intensity induces mutations in Drosophila sperm.

1056 Action of Gonadotrophins and of Oestrogens on X-Rayed Mouse Ovaries by G J Van Eck-Vermande and J Freud Arch Intern Pharmaco 78 67-78 (1949) Jan 1

Mouse ovaries irradiated with 330 r and 660 r are moderately responsive to human placental, mare seral, and horse hypohyseal gonadotropins. The response of irradiated ovaries is continually simplified in comparison with those of normal mice as the time after irradiation increases and prospective follicle forming structures disappear. The final result is eutrophy of interstitial ovariocytes, when hardly anything else remains in the irradiated ovary. The estrus and progestational activity of these ovariocytes is indicated in the genital accessories. The immediate destruction of follicles by X-rays is irreparable. But the "secondary" damage caused by irradiation on follicles that develop in subsequent batches is greatly reduced either by estrogens or by hyphyseal gonadotrophin. After such treatment primary follicules show abundant granulosae, secondary follicules do not fail to develop, luteinisation follows, and corpora lutea can assume the pregnancy type. Poorly enveloped oocytes and anovular follicles are found. The theoretical implications, especially doubt as to the existence of follicle stimulating hormone and luteinizing hormone, concerning the cycle and the alleged inhibition of the hypophysis by moderate doses of estrogens are discussed.

1057 Effect of Ionizing Radiations on Reproductive Cells and White Blood Cells by Harry W Mixer X-Ray Technician 20 215-218 (1949) Jan

Most investigators agree that white blood cells are the most radio sensitive in the body. Next to them are the reproductive cells. Ionization within the cell is probably the fundamental principle involved in all tissue changes produced by irradiation. These ionizing effects are reviewed by the author.

1058 Effect of X-Rays on Fertility in White Leghorn Male Chickens Treated Before Puberty by Paul D Sturkie, John A Pino, J L Weatherwax, A J Donnelly and G M Dorrance Radiology 52 112-117 (1949) Jan

White Leghorn male chicks, 4 to 6 weeks of age, were irradiated with 1,200 to 8,400 r. The area irradiated included the testes, adrenals, and a part of the kidneys. Most of the males receiving 2,100 to 2,800 r were sterile when mated to females at maturity, whereas with doses of 1,600 r or less most or all were fertile. All males receiving 5,600 and 8,400 r were sterile. The treatments had no effect upon the comb growth and mating behavior. The testes of the irradiated males were reduced in size, the decrease being proportional to dosage, though some of the observed differences were not significant. This work shows that the histologic state of the testes is not always a reliable criterion of fertility. Of the sections studied from the testes of adult males receiving the different treatments, those from only one male suggested that there was any recovery from the treatment. The probable changes which occur in the testes from prepuberty to maturity following irradiation with x-rays are discussed.

1059 The Increased Tolerance of Mice to a Lethal Dose of X-Ray Radiation as a Result of Previous Sublethal Doses by Eugene P Cronkite, Clyde R Sipe, Dean Eltzholtz, William H Chapman and F W Chambers. Naval Medical Research Institute Report No.15 Aug 17 1948 6p (NP-589)

It has been demonstrated with a fair degree of certainty (probability that results are due to chance, calculated by a pooled Chi square found to be between 0.02 and 0.05) that three weekly exposures of 144 r followed by a 30 day rest period increases the resistance of mice to a subsequent lethal dose of x-radiation. It is concluded that no adequate explation for this phenomenon of increased tolerance to x-ray radiation is available at the present time. 14 references.

BIOLOGICAL EFFECTS OF RADIATION (continued)

1060 Induced and Naturally Occurring Mutations by Donald F Jones [In "Proceedings of the Auburn Conference on the Use of Radioactive Isotopes in Agricultural Research, December 18-20, 1947," Auburn, The Alabama Polytechnic Institute, 120-123 (1948)]

The author briefly explains the nature of mutations. He points out that it is entirely premature to talk about what atomic radiation is going to do in the applied field of plant and animal improvement, since no one knows what is going to happen through the use of induced mutations. Degenerate and defective mutations caused by radiations are not considered to be so unfavorable as they might seem at first sight, for induced changes from any source increase variability which plays an important part in plant and animal improvement.

1061 Quantitative Histologic Analysis of the Effect of Chronic Whole-Body Irradiation with Gamma Rays on the Spermatogenic Elements and the Interstitial Tissue of the Testes of Mice by Allen B Eschenbrenner, Eliza Miller and Egon Lorenz J Natl Cancer Inst 9 133-147 (1948) Dec

LAF_1 male mice were exposed to 8.8 r, 4.4 r, or 1.1 r, respectively, whole-body γ-radiation given in 8 hours daily beginning at 2 months of age. Four mice on each dose level and 4 nonirradiated mice of the same age were killed at intervals of 2 months after 2 to 16 months of irradiation. Only the findings in the testes of these mice are reported. Data include fresh testes weights, quantitative histologic analyses of the relative and absolute amounts of interstitial tissue per testis and of the cells in different stages of spermatogenesis in the seminiferous tubules, and analyses of the morphology of Bowman's capsules in the kidneys as an index of hormone output of the testes.

In mice exposed to 4.4 r and 8.8 r daily there was a sharp decrease of testes weights after 2 and 4 months of irradiation. Thereafter the weight curves leveled off at different values for the different dose rates. The relative amount of interstitial tissue increased in proportion to decrease of testes weights. Quantitative histologic analysis showed this relative increase was not an absolute one, the quantity of interstitial tissue per testis remaining the same as that of the testes of nonirradiated mice. Analysis of the morphology of the kidneys revealed no evidence of measurable decrease of hormone output of the testes of irradiated mice.

Despite marked decrease of total quantity of spermatogenic elements in the testes of irradiated mice, the proportion of these cells in different stages of spermatogenesis was normal in mice exposed to 1.1 r and 4.4 r daily for as long as 16 months. In mice exposed to 8.8 r daily, it was normal for 4 months, while after 6 or more months of irradiation, there was failure of completion of spermatogenesis, and this was associated with degeneration of Sertoli cells. Some theoretical implications of the data are discussed, and the practical value of the mouse testis as a test object in quantitative experiments on the biologic effect of radiation is indicated.

1062 Radiation Damage of Genetic Origin by H J Muller J Heredity 39 357-358 (1948) Dec (Abstract of National Sigma Xi Lecture)

The great majority of gene mutations are harmful in some way. High energy radiations are the only outside agents found so far that are capable of affecting mutation frequency to a very marked degree. The dose received during a fluoroscopic examination of the abdomen if received by the gonads would cause about as many mutations as occurs naturally during an individual's reproductive life-cycle. Such a dose probably carried something like a 5% chance of handicapping several descendants and of finally killing one of them. Since there is a lapse of many generations before the mutation effect is felt, present investigators, unless they realize that they also run some risks of damage, may be careless of the future generations.

CHEMISTRY, ANALYTICAL

1063 On the Determination of Radioactive Hydrogen by Lars Melander Acta Chem Scand 2 440-446 (1948)

The author has devised a method whereby tritium determinations may be made accurately within ±2% without the use of a high-vacuum pump or cooling agents such as liquid air. The tritium sample,

CHEMISTRY, ANALYTICAL (continued)

assumed present as water, is reduced to hydrogen with magnesium turnings and a part of the active hydrogen gas introduced together with methane into a Geiger-Müller tube. It is shown that the measured activity is proportional to the amount of tritium present in the counter tube, holding independently of the total hydrogen pressure and the absolute amount of tritium over large intervals. A schematic drawing and a picture of the apparatus as well as graphs of the measured activity are shown.

CHEMISTRY, GENERAL

1064 On the Possibility for Noble Gases Forming Compounds with Aluminum Bromide and Chloride (O vozmozhnosti obrazovaniya blagorodnymi gazami soedinenii s bromistym i khloristym aluminiem) by B A Nikitin and E M Ioffe Doklady Akad Nauk 60 595-597 (1948) May 1 (In Russian)

The similarity of electronic shells in noble gases and in volatile hydride, such as H_2S or PH_3, explains the formation of molecular compounds of noble gases with H_2O, phenol, and toluol, analogous to the corresponding compounds of volatile hydrides [Nikitin, Izvestiya Akademii Nauk, Otdelenie Khimicheskikh No. 1 (1940)]. The analogy is further illustrated by the existence of solid solutions of the corresponding molecular compounds. Since $AlBr_3$ and $AlCl_3$ are known to form compounds with many substances, and in particular with H_2S, the authors attempted to react $AlBr_3$ and $AlCl_3$ with radon, the latter element being, among the rare gases, the least resistant to chemical action. The method used was an isomorphic co-precipitation of Rn during the formation of $AlBr_3.H_2S$ and $AlCl_3.H_2S$. In the presence of Rn, gaseous H_2S acted on powdered $AlBr_3$ at ordinary temperature (or molten $AlCl_3.H_2S$ slowly crystallized in the presence of Rn). Whereas H_2S passed over into the solid (or molten) phase almost quantitatively, radon entered it in relative quantities small enough to be considered mechanical admixtures. The authors concluded that the rare gases do not form compounds with $AlBr_3$ and $AlCl_3$. This result seems also to indicate that the formation of the corresponding compounds with H_2S should not be ascribed to the van der Waals forces, but rather to an interaction between the negatively charged Al atom and the positive S atom.

1065 Preparation of Radioactive CO_2 from $BaCO_3$ by Norman Zwiebel, John Turkevich and Warren W Miller J Amer Chem Soc 71 376-377 (1949) Jan

This article is based on AECU-72. An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. II-907.

COSMIC RADIATION AND MESONS

1066 Apparatus for Cloud-Chamber Investigations with Free Balloons by E J Lofgren, E P Ney and F Oppenheimer Rev Sci Instruments 20 48-51 (1949) Jan

Apparatus for taking cloud-chamber pictures in free balloon flights is described. The 12-inch cloud chamber is photographed once per minute by stereo cameras. The complete equipment for a six-hour operation at 90,000 to 100,000 feet weighs 65 pounds and is housed in a 30-inch diameter gondola equipped with temperature control. Photographs and diagrams of the apparatus are shown.

1067 The Generation of the Hard Component of Cosmic Rays (Generatsiia zhestkoi komponenty kosmicheskikh luchei) by A Sakharov. Zhur Eksptl i Teoret Fiz 17 686-697 (1947) (In Russian)

The generation of the hard component of cosmic rays by photons and nucleons in the relativistic region and near the border of generation is investigated in the case of two certain assumptions concerning interaction of nucleons.

COSMIC RADIATION AND MESONS (continued)

1068 Observations With Electron-Sensitive Plates Exposed to Cosmic Radiation by R Brown, U Camerini, P H Fowler, H Muirhead and C F Powell Nature 163 82-87 (1949) Jan 15

The mass of a heavy charged particle has been evaluated from its 3000-μ path in a photographic plate emulsion exposed to cosmic radiation. The mean value obtained for the mass of the particle, using a grain counting method, was 1080 $\pm$ 160 m_e. A study of the small-angle scattering of the particle, by the methods recently described. [Goldschmidt-Clermont, King, Muirhead and Ritson, Proc Phys Soc 61 138 (1949)], resulted in a value of 1800 $\pm$ 400 m_e which is probably not as accurate as the lower value. The track of the heavy particle terminated in tracks which were attributed to three ejected particles. The following possible explanations of the observed events are discussed: 1) transmutation, 2) spontaneous decay, 3) chance juxtaposition of unrelated events. The second of the aforementioned possibilities is believed to be the most likely and it is noted that although there is some evidence to indicate that the three product particles are π-mesons, the alternative possibilities that one or two of the particles are μ-mesons cannot be excluded. Previous evidence for the existence of a particle having a mass of approximately 1000 m_e is discussed.

1069 On the Multiple Production of Penetrating Particles in Water and in Iron by H A Meyer, G Schwachheim and A Wataghin Anais Acad Brasil Cienc 20 257-260 (1948) Sept 30

Experiments have been performed to determine the ratio of the cross sections for production of local penetrating showers in water and in iron. The four-fold coincidence arrangement used, which has been previously described [Phys Rev 71 453 (1947)], is shown. The tabulated data obtained indicate that there is a larger production of showers per nucleon in water than in iron. This disproves the following: 1) that for the shower producing radiation responsible for the observed local showers, the nuclear forces are negligible; 2) that the production is simply mass proportional. It is noted that in the experiments the ratio of the nuclei in water to those in the iron was 9:1 while the ratio of the total geometrical nuclear cross sections was found to be 1.8.

1070 On the Primary Cosmic Rays by G Wataghin Anais Acad Brasil Cienc 20 255-256 (1948) Sept 30

Recent experimental results [Phys Rev 73 1129 (1948) and 73 1395 (1948)] are briefly discussed which are in agreement with the process of multiple creation of mesons previously proposed by the author [Symposium sôbre raios cosmicos, Acad Bras Ci (1941)]. It is suggested that cosmic rays may have their origin in a large number of nuclei and nucleons which could have escaped during the process of aggregation into stars during the origin of the universe [Phys Rev 73 79 (1948)].

1071 Slow Mesons in the Heights 900-4700 Meters (Medlennye mezony na vysotakh 900-4700 m) by G B Zhdanov and A A Naumov Doklady Akad Nauk SSSR 60 1519-1521 (1948) (In Russian)

The article shows the general arrangement of the measuring instruments (in two variations) used for the experiments, which have been carried out at 900, 3860 and 4700 m height. The results of the experiments are discussed.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1072 Effective Mass of the Polaron (Effektivnaia massa poliarona) by L D Landau and S I Pekar Zhur Eksptl i Teoret Fiz 18 419-423 (1948) (In Russian)

It is assumed that the conductor of current in an ionic lattice is not a conducting band electron but a polaron. The conservative motion of the polaron as a whole is examined. The energy dependence of the system is given as a function of the alternating motion of the polaron and equation of motion of the polaron in an external field.

1073 The Method of Effective Masses of Electrons in Crystals (Metod effektivnoi massy elektrona v kristalle) by S I Pekar Zhur Eksptl i Teoret Fiz 16 933-966 (1946) (In Russian)

By means of quantum mechanics the movement of electrons in a field is calculated. The potential of the field may be considered to consist of two components: (1) the periodic oscillating potential of

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE (continued)

the type in a crystal, and (2) the smoothly varying potential, which changes very little during one cycle of the periodic potential defined under (1). The limitations for the application of this method, which is based on the introduction of the effective mass of the electron, are indicated.

DEUTERIUM AND DEUTERIUM COMPOUNDS

1074 Attempt to Detect an (n,2n) Reaction in Deuterium by L G Elliott, E P Hincks and A N May Can J Research 26 386-403 (1948) Nov

A detailed account is given of experiments carried out to detect an (n,2n) reaction in deuterium. A Po-α-Be neutron source was surrounded by a hollow aluminum sphere 30 cm in diameter which could be filled with heavy water, and the sphere was surrounded by an effectively infinite medium of paraffin oil. The neutron density distribution outside the sphere was measured with a small boron trifluoride chamber (6 mm diameter X 20 mm long) and the total integrated densities of neutrons were determined both with the sphere empty and filled with heavy water. After correcting for absorption of thermal neutrons by the heavy water, the aluminum sphere, and the source, and of fast neutrons by the oxygen of the heavy water, it is shown that the fraction of neutrons giving an (n,2n) effect is $0.1 \pm 2.7\%$. This indicates that the effect is less than both that predicted by Höcker's theory ($\sim 10\%$) [Physik Z 43 236 (1942)] and that reported from an earlier experiment by Halban and co-workers (18%) [Unpublished report, Br-3, British Atomic Energy Project 1941]. However, it is in good agreement with measurements made by Fenning and Knowles ($1.4 \pm 5\%$), [Unpublished report MP-41].

HEALTH PROTECTION

1075 Protective Precautions in the Handling of Radioactive Materials by G William Morgan [In "Proceedings of the Auburn Conference on the Use of Radioactive Isotopes in Agricultural Research, Dec 18-20 1947," Auburn, The Alabama Polytechnic Institute, 54-69 (1948)]

This comprehensive and compact paper contains discussions of the following topics: medical examinations for prospective radioisotope workers, planning a radioisotope laboratory, shielding, personnel monitoring, safe practices, selection of experimental apparatus, planning and monitoring operations, surveying areas for contamination, decontamination, and disposal of radioactive materials.

1076 Protective Procedures by Herbert M Stauffer X-Ray Technician 20 219-222 and 239 (1949) Jan

The most vital protective procedure is constantly to remember that there are definite hazards connected with work with ionizing radiation. In addition, the equipment and type of installation should meet accepted standards. Technicians should perfect working habits which permit a minimum exposure in the work setup, and exposure of personnel should be periodically monitored by the film or portable meter method.

ISOTOPES

1077 Mass Spectrographic Assignment of Rubidium Isotopes by Frederick L Reynolds, D G Karraker and D H Templeton Phys Rev 75 313-314 (1949) Jan 15 (Letter to the editor)

This article is based on AECD-2373. An abstract of this document has been listed in Nuclear Science Abstracts as abstract No. I-1892.

MASS SPECTROGRAPHY

1078 Improved Magnetic Focusing of Charged Particles by Larkin Kerwin Rev Sci Instruments 20 36-41 (1949) Jan

A general theory of geometric magnetic focusing of charged particles is developed. Some special cases are discussed; these include the type of focusing in general use and another equally simple type which eliminates second-order aberrations.

METALS AND METALLURGY

1079 Sintering Carbides by Means of Fugitive Binders by Laurence S Foster. AECD-2464 (MIT-1014) nd Decl Jan 28 1949 34p Proposed for publication in Metals Tech

The question as to whether the structure of hard carbides such as those of W, Ta, and Cb bonded by means of a metallic cementing phase such as cobalt is one of discrete grains of the carbide supported in a continuous cobalt-rich phase, or one containing a strong carbide skeleton structure with the interstices filled with the metal-rich phase, is subject to much debate. Results of experiments reported here, in which very small amounts of cementing phase were used, give support to the carbide skeleton theory. Strong structures still result even in the complete absence of cementing phase. A possible explanation of the decline in bond strength, observed when the amount of cementing agent is decreased, may be the mechanical difficulty of producing specimens that are free from microporosity and other flaws, rather than inherent weaknesses of the materials themselves. Experimental procedures for sintering tungsten, tantalum, and columbium carbides using nickel and cobalt as binders, and the characteristics and properties of such sintered specimens are reported.

1080 The Constitution and Properties of Alloys Containing Tantalum and Columbium by Rupert H Myers Metallurgia 39 No. 230 57-62 (1948) Dec

This article is a supplement to an earlier paper, which reviewed the literature on the chemistry and metallurgy of tantalum and columbium, and deals with information which is available on alloys containing these metals. Several phase diagrams, alloy compositions and tables are presented. One table is an excellent summary of available data on binary alloys of tantalum and columbium. From this survey of the literature on the alloys which contain tantalum and columbium it will be seen that most of the systems have been studied from the lower melting point end and consequently very few data are available on tantalum and columbium-rich alloys. The following summary lists the various binary-alloy systems, for which information on the constitution is available (a) alloys with tantalum or columbium as the major constituent: tantalum carbide (TaC), Ta-Mo, Cb-Mo, Ta-W, Cb-W, Cb-Ta. (b) alloys with tantalum or columbium as the minor constituent: Co-Ta, Co-Cb, Fe-Ta, Fe-Cb, Mo-Ta, Mo-Cb, Ni-Ta, Ni-Cb, W-Ta, W-Cb.

A great deal of work remains to be done in connection with the properties of these alloys and of new ones which have not yet been investigated.

1081 Contribution to the Chemistry of Gallium by B N Ivanov-Emin and J I Rabovik Zhur Obshchei Khimi 17 1247-1252 (1947) (In Russian)

The capacity of gallium to form sulpho-salts as shown in this paper relates it to its analogues--indium and thallium--and makes it totally distinct from aluminum. The composition and main properties are studied of several sulphogallates.

1082 Dynamic Properties of Materials: Numerical Study of Factors in the Stress Concentration Theory as Applied to the Hysteresis and Fatigue of Metals by Paul R Shepler. Lessells and Associates Technical Report No. 2 (Office of Naval Research) Dec 15 1948 68p

A critical examination is made of the application of this stress concentration theory to hysteresis and fatigue by noting the effect of numerical changes in all pertinent factors on the specific damping vs cycles, ψ-N, and the stress vs cycles, S-N, curves. Comparisons are shown between a theoretical curve for specific damping capacity vs cycles, ψ-N, predicted from stress concentration analysis and a curve obtained for data for a .22 carbon steel, St 42.11, in torsional fatigue. A good fit of theoretical to experimental curve occurs in the region of the ψ-N curve, just prior to the hysteresis peak value and thereafter from 2×10^5 cycles and more. In the region immediately preceding the hysteresis peak value, i.e. from 10^3 to 2×10^5 cycles, values of specific damping are greater theoretically then experimentally, when theory is based on stress concentrations being present from the start of the fatigue phenomenon. This makes it reasonable to believe that from 10^3 to 2×10^5 cycles, stress concentrations are being developed. Theoretical values of damping for incomplete development would then be lower in this region. Insufficient data for the experimental curve in this range indicate that it is not warranted

METALS AND METALLURGY (continued)

to formulate a law for the exact development of these concentrations. Stress vs cycle curves, S-N curves, predicted by the theory of stress concentrations, indicate the need for the appropriate theory of the development of stress concentrations. The S-N curves, on the basis that stress concentrations are present initially, are in reasonable agreement with those commonly obtained for steel. S-N curves, based on the assumption that the number of cycles to complete development of stress concentrations is independent of nominal stress level, appear remote from curves available for most steels.

1083 Theoretical Investigation of the Process of Alloying by Sintering by S Weinbaum. California Institute of Technology Progress Report No. 4-51 Nov 18 1947 10p (NP-585)

An article based on this document has been published in J Applied Phys 19 897-900 (1948) Oct. An abstract of the article appeared in Nuclear Science Abstracts as abstract No. I-1851.

MINERAL RESOURCES AND MINERALOGY

1084 '49 Uranium Rush Popular Mech 91 89-93 and 266, 268, 270 (1949) Feb

Some of the techniques used by the uranium-prospector are described and a world map showing the location of known uranium areas is given.

NEUTRONS

1085 The Scattering of Slow Neutrons by Paramagnetic Crystals by I W Ruderman, W W Havens Jr, T I Taylor and L J Rainwater. AECD-2462 (CUD-16) Dec 14 1948 Dec Jan 27 1949 9p Proposed for publication in Phys Rev

An abstract of this document was assigned the number AECD-2417. The abstract was listed in Nuclear Science Abstracts as Abstract No. II-525.

1086 Effect of Neutron Bombardment on Order in the Alloy Cu_3Au by Sidney Siegel. AECD-2465 nd Decl Feb 1 1949 5p Proposed for publication in Phys Rev

In an order-disorder alloy, the possibility exists for observing effects produced by the displacement of atoms, and of lattice vibrations of excessive mean energy, even after the displaced atoms have gone back to lattice sites, for the degree of order of the lattice may have been changed. This change in order will be substantially permanent if the neutron exposure is carried out at a temperature at which no change in order occurs normally due to conventional thermal annealing. An example of such an alloy is Cu_3Au, which can be permanently kept in any state of order by appropriate heat treatment, if the temperature is not subsequently raised above about 200°C. Samples of the alloy Cu_3Au were prepared in the form of rods 0.3 mm in diameter, 7 cm long. Ordered samples were prepared by slow cooling from 400°C during about 50 hours. The samples were exposed in a chain reactor for various periods, in a position where the integrated flux of neutrons of energy higher than 50 kev, times the times of exposure, has the values nvt tabulated. In each case an initially well-ordered and initially disordered sample were exposed. The values of the resistivity of these samples before exposure, the integrated neutron flux, and the final resistivity values are given. It is evident that the electrical resistance, and presumably the degree of disorder, or the initially well ordered samples increases with neutron exposure. The samples are so strongly radioactive shortly after exposure that convention x-ray diffraction study of degree or order through superlattice lines is difficult. However, after the samples had decayed for many months, x-ray evidence confirmed the fact that the initially-ordered samples had become disordered. Other deductions are made.

1087 Neutron Cross Section for Neodymium Isotopes by David C Hess Jr and Mark G Inghram. AECD-2470 (ANL-AJD-245) June 9 1948 Decl Feb 14 1949 3p

Of the stable isotopes between Zr^{90} and Bi^{209}, only a few have thermal neutron absorption cross-sections greater than 5×10^{-24} cm^2 (5 barns). The determination of the masses of these large cross-section isotopes is of importance as a basis for nuclear theory. The absorption cross-section of

NEUTRONS (continued)

normal neodymium for thermal neutrons is 90 x 10^{-24} cm^2, and the sum of the known activation cross-sections is less than one barn, consequently it should be expected that one or more isotopes have a large cross section and absorb neutrons to form other stable isotopes of neodymium. A large absorbing isotope in neodymium has been found at mass 143; its absorbing cross section is approximately 730 barns.

1088 The Effect of Crystal Orientation on the Scattering of Slow Neutrons by G P Arnold, V W Myers and A H Weber Phys Rev 75 217-220 (1949) Jan 15

A simple theory is developed for taking into account non-random orientations in microcystalline material of the hexagonal system. The transmission of slow neutrons through extruded and through powdered graphite is measured experimentally and compared with the theory.

1089 The Magnetic Moments of the Neutron and Proton by J M Luttinger Phys Rev 75 309-310 (1949) Jan 15 (Letter to the editor)

See Nuclear Science Abstract II-775.

1090 On the Definition of the "Effective Range" of Nuclear Forces by F C Barker and R E Peierls Phys Rev 75 312-313 (1949) Jan 15 (Letter to the editor)

The author shows that the "effective range" as defined by Blatt [Phys Rev 74 92 (1948)], in his discussion of neutron-proton force, can be expressed by elementary means in terms of the wavefunction for zero energy.

NUCLEAR PROPERTIES

1091 Investigations on the Binding Energy of Heavy Nuclei by R Huby Proc Phys Soc 62A 62-71 (1949) Jan 1

Approximate calculations of the binding energy of a heavy nucleus have been performed, taking the static interaction of Møller and Rosenfeld as the nuclear force. The parameters appearing in the interaction have been fixed by data on light nuclei. Ther Fermi-gas model was taken as a basis for the calculations, a first solution being obtained by a first-order perturbation (or variation) method. For refinement, a second-order perturbation calculation was made, and Svartholm's variation-iteration method (Thesis, 1945) was attempted. The first-order results yielded about 10% of the required energy, and the second-order about 40%; a reasonable prediction of the size of the nucleus was obtained. It is concluded that the reliability of the perturbation results is uncertain; Svartholm's method does not appear to be well suited to the investigation of heavy nuclei. By making 2 alternative modifications of the nuclear force, the correct binding energy (according to the perturbation calculation) was obtained.

1092 Nuclear Shell Structure and Isomerism by Eugene Feenberg Phys Rev 75 320-322 (1949) Jan 15 (Letter to the editor)

A closed shell of 40 particles having the structure $(1s)^2(2p)^6(3d)^{10}(4f)^{14}(3p)^6(2s)^2$ is suggested by the properties of odd nuclei containing 37, 39 and 41 neutrons or protons. The evidence from isomerism for the proposed shell structure is summarized in tabular form.

1093 On the Production of Nuclear Polarization by M E Rose Phys Rev 75 213 (1949) Jan 1 (Letter to the editor)

This article is based on AECD-2119. An abstract of the document has been listed in Nuclear Science Abstracts as Abstract I-666.

NUCLEAR TRANSFORMATION

1094 Absolute Voltage Determination of Tnree Nuclear Reactions by R G Herb, S C Snowdon and O Sala Phys Rev 75 246-259 (1949) Jan 15

NUCLEAR TRANSFORMATION (continued)

A large electrostatic analyzer was used in conjunction with the Wisconsin electrostatic generator for an absolute voltage determination of the $Li^7(p,n)Be^7$ threshold, an $Al^{27}(p,\gamma)Si^{28}$ resonance, and a $F^{19}(p\alpha',\gamma)O^{16}$ resonance. Using absolute volts the values found are 1.882 Mev, 0.9933 Mev, and 0.8735 Mev, respectively. The uncertainties in the measurements appear to be about $\pm 0.1\%$.

PARTICLE ACCELERATORS

1095 Ion Path Plotting and Cyclotron Deflector Design by W W Schultz. General Electric Co Schenectady N Y Report No. 33196. June 3 1946 29p

The report furnishes preliminary information and data on which the design of an actual cyclotron deflecting system can be based. Inasmuch as graphical methods have heretofore been employed in locating ion paths in the cyclotron from the exit radius outward, it seemed desirable to develop a more accurate method. The method developed is used in the design of a deflector channel, which passes ions of a range of energies and a range of entering angles. It is of importance to the designer and to the operator of a cyclotron, to know the effect of a change of deflector potential on the ion paths, and the effect of deflector-beam splitter spacing on the ion paths. The effect of these variables is studied by means of a number of path plots. An empirical equation is developed for the purpose of locating ion paths approximately for various deflector potentials. The effect of a change in deflector-beam splitter-spacing is shown to be small. It is shown that a deuteron and a proton can be made to follow the same path in identical magnetic fields by changing the deflector potential. This assumes that the frequency change necessitated by the change of particle mass is attainable. Three methods of setting up the electric deflector field are suggested.

1096 Orbital Stability in a Proton Synchrotron by R Q Twiss and N H Frank Rev Sci Instruments 20 1-17 (1949) Jan

The proton synchrotron exhibits a number of distinct and important differences from the electron synchrotron, particularly at low energies. The theory for the proton accelerator is developed with particular reference to the problems of injection and stability in the initial acceleration period. This theory is used to set up criteria relating the dimensions of a proton synchrotron to the conditions for stability and to the beam intensities obtainable.

PHYSICS, NUCLEAR

1097 Radioactivity Phenomena and Introduction to Nuclear Physics (Phénomènes Radioactifs et Introduction à la physique nucléaire) by Georges Grieben. Paris, Dunod nd 261p

This book is based upon lectures given at the University of Liege, Belguim. The following topics are discussed: Ionization of Gases; Methods of Measuring Radioactivity; the Properties of α-, β-, and γ-Radiations; Secondary Radiations Produced by α-, β-, and γ-Rays; Radioactive Disintegration Phenomena; Specific Characteristics of Radioelements (isotopes of radioelements, law of displacement, tables of radioactive elements); Separation of Isotopes; the Naturally-occurring Radioactive Elements; Properties and Reactions Produced by Radiations; Nuclear Collision Forces Surrounding the Nucleus; Artificial Disintegration of Elements; Fission of Uranium and Thorium by Neutrons; Applications and Uses of Radioisotopes; Relations between Radioactivity, Geology and Geophysics; Cosmic Radiation; and the Constituents, Properties and Structures of Atomic Nuclei.

PHYSICS, NUCLEAR - METHODS OF MEASURING

1098 Chicago Pressure Ionization Chamber for Gamma Ray Measurement by F R Shonka and R J Stephenson. AECD-2463 (MUC-RJS-2) July 1 1944 Decl Jan 21 1949 16p

The measurement of the intensity of γ-rays from solutions may be made by means of a pressure ionization chamber. This problem is of importance in the determination of gammas in chemical decontamination processes. The decontamination γ-ray sample of known volume is placed in a glass test tube and lowered into the metal thimble in the ionization chamber. The ionization current is then the sum of that due to background and to the γ-ray sample. Since the electrostatic capacity of the system remains constant and the electrometer needle is always timed over a given number of divisions, say 50, the current is inversely proportional to the time required to move over the 50 divisions. Thus the ionization current due to a γ-sample is obtained by subtracting the inverse of the drift times due to a γ-sample and background from the inverse of the time for background alone. Complete detail drawings are attached.

1099 On the Use of Photographic Plate Detectors in Neutron Experiments by John C Allred, Anne N Phillips, Louis Rosen and Francis K Tallmadge. AECD-2466 (LADC-602) nd Decl Feb 4 1949 11p Proposed for publication in Phys Rev

In order to determine whether prolonged exposure to a vacuum changes the resolution or stopping power of photographic emulsions, the range distributions of plutonium alpha particles were obtained as a function of time spent by photographic plates in a vacuum. It was found that the vacuum produces no significant effect on the resolution or stopping power. Graphs and drawings show the following: range distribution of plutonium alpha particles as determined from photographic plates exposed in a vacuum for 1, 6-1/2, and 16-1/2 hours respectively; source detector geometry for energy spectra of charged particles from thermal neutron reactions; range distribution of alphas from $B^{10}(n, \alpha)Li^7$ reaction for thermal neutrons; range distribution of tritons and alphas from $Li^6(n, \alpha)H^3$ reaction for thermal neutrons; source detector geometry for neutron energy spectra determinations; and energy distribution of 14-Mev neutrons as determined from ranges of recoil protons.

1100 Current Fluctuations in Ionization Chambers with Finite Time of Ion Collection (O Fluktuatsiyakh Toka v Ionizatsionnoĭ Kamere s Konechnym Vremenem Sobiraniya) by I Ya Barit and M I Podgoretskii Doklady Akad Nauk SSSR 60 563-566 (1948) May 1 (In Russian)

In theoretical studies of current fluctuations in ionization chambers it was always assumed that the collection of ions took place in a negligibly small interval of time, and that all particles performed the same amount of ionization. The present authors, using a method free from these assumptions, obtained formulas for the relative fluctuation which take into account several factors involved, such as the distribution of ions within the chamber and the relative mobility of ions of different signs. A particular case is the use of the ionization chamber for the observation of single impulses, e.g. in the study of cosmic rays. When applied to this case, the theory shows that the magnitude measured should be the slope of the oscillogram, rather than the amplitude.

1101 Distant Counting of Scintillations by E P Blizard and S DeBenedetti Rev Sci Instruments 20 81 (1949) Jan

Two of the limitations to the use of scintillation counters with photo-multipliers have been circumvented by separating the crystal and the photo-multiplier and focusing or canalizing the scintillation light. The difficulties avoided were: a) the inoperability of photo-multipliers in strong magnetic fields, and b) the fact that the pulse-height distribution is perturbed by the direct response of the multiplier to radiation.

PHYSICS, NUCLEAR - METHODS OF MEASURING (continued)

1102 A Double-Channel, Direct Reading, Low Frequency Counting Rate Meter and Counting Rate Comparator by Robert M Kloepper and Frank E Hoecker Rev Sci Instruments 20 17-22 (1949) Jan

A circuit primarily designed for the specific purpose of adjusting 2 atmospheric pressure wire plate α-particle detectors [Chang and Rosenblum Phys Rev 67 221 (1945)] to equal average pulse rates is described. The circuit consists of a two-channel, direct reading counting rate meter for measurement of low frequency (average random or uniform) pulse rates in either channel or in both channels simultaneously. The outputs of 2 degenerative vacuum-tube voltmeter integrating circuits are combined into a bridge circuit whereby the equality of pulse rates in the 2 channels may be determined on a null-reading galvanometer. An impulse register amplifier is provided on each channel for operation of impulse counters for monitoring and/or calibration. The 5 ranges provided are 0-100, 200, 500, 1000, and 5000 pulses per minute. The circuit design may be modified to detect pulse rate ratios other than unity, pulse rate differences, and/or pulse rate ranges other than those enumerated above. The circuit diagram is shown and the magnitudes of the components are given.

1103 The Electron Multiplier as a Counter for 10 Kev Protons by J M Robson. National Research Council of Canada Report CRP-383 July 12 1948 22p

An article based on this document has been published in Rev Sci Instruments 19 865-871 (1948) Dec. An abstract of the article appeared in Nuclear Science Abstracts as abstract No. II-546.

1104 A Flash Lamp for Illuminating Vapour Tracks in the Wilson Cloud by N Warmoltz and A M C Helmer Philips Tech Rev 10 178-187 (1948) Dec

A short description of the Wilson cloud chamber is followed by a discussion of the conditions to be met by a flash lamp suitable for the illumination of cloud chamber tracks. A description is then given of a flash lamp specially designed by Philips for this purpose. The latter is an elongated, xenon-filled tube across which a condenser, charged to several kilovolts, is discharged via a choke. The resultant flash has a duration of a few milliseconds. The lamp is simple in use and highly efficient; the accompanying photographs give some idea of the results to be obtained. Finally, some of the characteristics of the lamp in question are discussed.

1105 Further Experiments with an Adjustable Geiger-Müller Counter by A G Fenton and E W Fuller Proc Phys Soc 62A 32-40 (1949) Jan 1 (See also Nuclear Science Abstract I-1879)

An adjustable Geiger-Müller counter and special electronic circuits have been used to study the effect of several counter variables on the occurrence of multiple pulses. The results show that the plateau characteristics combine the effects of an increase in efficiency and an increase in the probability of a multiple pulse as the operating potential is raised. It was found that the probability of occurrence of multiple pulses does not depend simply upon the charge per pulse, but that it depends also upon the anode diameter and the total pressure of the filling. Curves have been drawn showing the charge per pulse as a function of the operating potential. A change of slope occurs in these curves when the charge per pulse is approximately equal to the charge on the active portion of the anode. The counter was used as an ionization chamber at operating potentials below the Geiger region and it was found that as the potential is raised above the threshold of the proportional region the ionization current varies with potential as $\log I \propto V$ while at higher potentials the relation is adequately expressed by $\log \log I \propto V$. Near the Geiger region a sharp break occurs in the log log curve, which is taken to indicate that the discharge begins to spread at this stage.

1106 A Geiger-Mueller Counting Unit and External Quenching Equipment for the Estimation of C^{14} in Carbon Dioxide by W B Mann and G B Parkinson Rev Sci Instruments 20 41-47 (1949) Jan

A counter unit and external quenching circuit for use with carbon dioxide and carbon disulfide mixtures are described. The counter unit consists of both a long and a short counter to eliminate end

PHYSICS, NUCLEAR - METHODS OF MEASURING (continued)

effects. The quenching circuit, which depends on the action of a multivibrator, enables the voltage across the Geiger-Mueller counter to be reduced in a controllable manner by any desired amount and for any desired time.

1107 Grain Density in Photographic Tracks of Heavy Particles by M Blau Phys Rev 75 279-282 (1949) Jan 15

The relation between grain density in photographic tracks and particle energy has been derived theoretically assuming that the probability that a grain be developed is given by $P = c(1-\exp[-b(dE/dR)^{1/2}])$. Using a single pair of parameters b and c all experimental curves so far published for α-particles, tritons, protons, π and μ mesons (University of Bristol) can be represented with this equation. The agreement between experiments and theory is very satisfactory.

1108 Measurement of the Absolute Yield of a Phosphor Flash Induced by "Red" Light (Izmerenie absoliutnogo vykhoda vspyshki fosforov vyzvannoi deistviem "Krasnogo" sveta) by V V Antonov-Romanovsky. Zhur Eksptl i Teoret Fiz 17 708-710 (1947) (In Russian)

A new method is described for measuring the radiation yield of powdered phosphors. In this method use is made of the Lambertian character of the scattering of the incident and of the emitted light.

1109 The Measurement of Radiation by Paul W McDaniel [In "Proceedings of the Auburn Conference on the Use of Radioactive Isotopes in Agricultural Research, Dec 18-20 1947," Auburn, The Alabama Polytechnic Institute, 43-53 (1948)]

The methods regularly used for the detection and measurement of β- and γ-rays are presented. The construction of the Geiger-Mueller tubes and a simplified description of the mechanism of their counter action are followed by discussion of the uses of auxiliary electronic counter circuits, scaling circuits, the recording circuit, counting statistics, crystal counters, photo-counters, and photographic techniques. 59 references.

1110 A Portable Radiation Monitor by D G Wyatt J Sci Instruments 26 13-17 (1949) Jan

The design and constructional details are given for a portable radiation monitor of the ionization chamber d.c. amplifier type. On the most sensitive range, a 10% meter reading denotes an intensity of 0.01 r./hr. for X- and γ-rays over the energy range 100 Kev - 3 Mev. The ionization chamber has thick air-walls (0.95 cm of Bakelite) for the measurement of γ-radiation; by using sliding shutters, the wall thickness on one side of the chamber may be reduced for the detection of soft X-rays or opened for the checking of α- and β-contamination.

1111 A Scintillation Counter for Laboratory Counting of Alpha Particles by J D Graves and J P Dyson. Naval Radiological Defense Laboratory Report ADI-28 Sept 7 1948 25p

A simple, reliable, wide-range alpha counter has been developed which is suitable for the routine counting accompanying radiochemical laboratory analysis. This instrument utilizes the alpha scintillation process in conjunction with a photomultiplier tube and a commercial Geiger tube power supply, amplifier, and scaler. Desirable features include low cost, ease of construction, ruggedness, and long life. Tests performed on the completed counter assembly indicated the following operating characteristics: a counting efficiency of 100 percent for 4-5 Mev alpha particles; a resolving time limited by the electronic circuits (photomultiplier pulses have a rise time of about 0.5 microseconds); a counting rate unaffected by variations of temperature, humidity, or pressure; and a background below 10 counts per hour. The chief undesirable feature is the small field of view for high sensitivity. Samples to be counted must be small, about $1/4'' \times 1/2''$ maximum, and must be confined to a known region on a sample holder.

PHYSICS, NUCLEAR - METHODS OF MEASURING (continued)

1112 Single Crystal Growth of Scheelite by S Zerfoss, L R Johnson and O Imber Phys Rev 75 320 (1949) Jan 15 (Letter to the editor)

Experiments have been made which indicate that single crystals of scheelite, $CaWO_4$, of sufficient purity and size for γ-ray counter applications can be grown by two techniques: (a) by flame fusion, the Vernueil process, and (b) from the melt by the gradient technique. Material of the size $4 \times 4 \times 4$ mm was obtained by method (a). The gradient technique was found to be more satisfactory, and single crystal boules yielding fragments $5 \times 5 \times 5$ mm were obtained by this method.

1113 The Statistical Theory of the Dead Time Losses of a Counter by C E Clark Rev Sci Instruments 20 51-52 (1949) Jan

In the case of events at random times, the number of events must be estimated from the number of counts recorded by a counter. The statistical distribution of the unknown number of events has been studied. It is shown that this distribution is approximately normal, and an approximate determination of the standard deviation is obtained.

PHYSICS, THEORETICAL

1114 The "Classical" Electron Wave-Field by Mario Schönberg Anais Acad Brasil Cienc 20 227-245 (1948) Sept 30

The quantum theory of the actions at a distance between electrons is discussed in a second quantization. It is shown that the usual treatment of the quantized fields can not be used in a theory with actions at a distance and a suitable modification is given. The modified formalism can be applied to collisions but it does not allow the direct introduction of the stationary states and does not give a detailed space-time description of the processes. The analysis indicates that the radiative effects can not be treated in the same way as the "actions at a distance", although it is possible to define operators for the retarded and advanced potentials of the electrons.

1115 Collision Problems and the Theory of Radiation Damping by J Hamilton Proc Phys Soc 62A 2-11 (1949) Jan 1

The relation between radiation damping theory and the problem of the radiationless collision of an electron with a field of force is discussed. It is shown that the divergence difficulties, such as appear in the damping treatment of Compton scattering do not arise, and the "cut-off" of damping technique is not necessary. The same result applies to the relativistic collision of two electrons.

1116 Damping Theory and the Propagation of Radiation by J Hamilton Proc Phys Soc 62A 12-18 (1949) Jan 1

It is shown that a careful examination of the concepts involved in radiation damping theory makes it possible to treat the propagation of energy from one atom to another through the electromagnetic field. An exact and continuous solution of the propagation problem is given.

1117 Exchange Integral with 3d Wave-Functions by E P Wohlfarth Nature 163 57-58 (1949) Jan 8

Precise calculations have been carried out on the exchange integral occurring in a first-order perturbation calculation of molecular energies on the basis of the Heitler-London treatment. The wave-functions used for the two separate atoms were of the 3d hydrogenic type, but having spherical symmetry. Calculations have been made for effectively the whole range of internuclear distances, and it is found that the exchange integral is negative over nearly all the range for which the first-order perturbation calculation gives a reliable approximation. Additional calculations of the Coulomb integral show that the energy of the $^1\Sigma$ state is always lower than that of the $^3\Sigma$ state, i.e, that the total spin in the ground-state of the molecule is zero.

PHYSICS, THEORETICAL (continued)

1118 Note on Dirac's Theory of Magnetic Poles by H A Wilson Phys Rev 75 309 (1949) Jan 15 (Letter to the editor)

The author shows how Dirac's result that $e_0 g_0 = hc/4\pi$ [Phys Rev 74 817 (1948)], where e_0 is the elementary electric point charge and g_0 the elementary point magnetic pole, can be obtained very simply from classical electrodynamics and quantum mechanics.

1119 On the Mesic Charge by Taisuke Okayama Phys Rev 75 308 (1949) Jan 15 (Letter to the editor)

Since the applicability of Dirac's hole theory depends critically upon the form of the interaction, the case for the meson field is discussed for the following types of interaction: 1) scalar mesic field, 2) pseudoscalar mesic field, 3) vector mesic field, and 4) pseudovector mesic field. The author investigates the conditions under which a hole in the negative energy state of the nucleon can be considered as a nucleon with the inverse mesic charge in the positive energy state.

1120 On the Theory of a Particle with a Spin 3/2 (K teorii chastitsy so spinom 3/2) by A S Davydov Zhur Eksptl i Teoret Fiz 17 427-436 (1947) (In Russian)

A spin-vector form of writing down equations for a particle with a spin 3/2 in the case when external fields are present is discussed in the paper. The case is considered of a particle having a zero stationary mass. The relation between the equations obtained and those proposed by Rarita and Schwinger is discussed.

1121 Quantum Mechanics by L I Schiff. New York, McGraw-Hill 1949 404p

The purpose of this book is to explain the physical concepts, to describe the mathematical formalism, and to present illustrative examples of the ideas and methods of quantum mechanics. It is intended to serve as a text at the graduate level and as a reference book. The book is developed according to the following chapters: Physical Basis of Quantum Mechanics, The Schrodinger Wave Equation, Eigenfunctions and Eigenvalues, Discrete Eignevalues (energy levels), Continuous Eigenvalues (collision theory), Matrix Formulation of Quantum Mechanics, Approximation Methods for Stationary Problems and Time Dependent Problems, Identical Particles and Spin, Semiclassical Treatment of Radiation, Structure and Properties of Atoms, Molecules, and Atomic Nuclei, Relativistic Wave Equations, Quantization of Wave Fields, and Quantum Electrodynamics.

1122 Remarks on the Determination of a Central Field of Force from the Elastic Scattering Phase Shifts by V Bargmann Phys Rev 75 301-303 (1949) Jan 15

It is shown by an explicit example that a central field of force is not uniquely determined by the phase shifts for an S-wave. Hylleraas' recent paper (Phys Rev 74 48 (1948)) is discussed, and an error in his argument is pointed out.

1123 A Representation of a Variable Spin (Representacão da Variável Spin) by Paulo Sérgio Anais Acad Brasil Cienc 20 261-271 (1948) (In Portuguese)

A solution is shown of Pauli's equation for hypercomplex functions of state. By considering as dynamical variables the matrices associated with the components of the spin vector, it is possible to describe the latter's behavior. This is illustrated on simple examples.

RADIATION CHEMISTRY

1124 Indium Replica for Metallurgical Examination by E B Roth. AECD-2461 nd Decl Jan 27 1949 13p

Investigation of the effects of pile radiation upon the properties of metals is reported. Among the effects investigated are those of radiation exposure upon the visible microstructure of materials such as would be detectable by the usual microscopic metallographic techniques. A method for metallographic examination of highly radioactive samples is developed. It was decided to investigate the

RADIATION CHEMISTRY (continued)

possibility of using a soft metal to take the impression. The use of indium metal was recommended because of its softness and extreme malleability at room temperature. Indium is considerably softer than lead and shows little or no tendency to work harden. At room temperatures, in foil form, it shows no visible crystal structure (that is, appears homogeneous with no grain structure whatsoever) at above 550X magnification. Furthermore, no nuclear reactions are known which would make the indium radioactive to a detectable degree if it were used as planned. Details of the technique are worked out for the backing and mounting. A procedure for taking the replica impressions is set up. Good reproductions up to 500 diameters have actually been observed, and identical areas on original and replica compared on adjacent microscopes. Most specimens show excellent reproduction at 100 diameters, and good to excellent reproduction at 250 diameters. Questions of etchants, depth of etch, etc., are discussed.

1125 The Production of Radioactive Cystine by Direct Bombardment in the Pile by Eric G Ball, A K Solomon and Octavia Cooper J Biol Chem 177 81-89 (1949) Jan

The authors have shown that it is possible to produce certain radioactive organic compounds by directly bombarding the desired compound in the pile. A sample of cystine was exposed in the Oak Ridge pile and yielded a sample of cystine containing radioactive sulfur with a specific activity of 112,000 counts per millimole per minute. The cysteine hydrochloride obtained by reduction with tin was crystallized from alcohol and was found to contain 98% of the theoretical radioactivity, while the cysteine hydrochloride obtained through electrolytic reduction possessed 82% of the expected radioactivity. In testing for the radioactivity source, an alkaline degradation was performed, tapping the sulfur as PbS and obtaining pyruvate hydrazone. The radioactivity of the precipitated $PbSO_4$ accounts for all the radioactivity, hydrazone being inactive.

RADIATION SICKNESS

1126 Failure of Rutin to Decrease the Mortality of Acute Ionizing Radiation Illness in Mice by Eugene P Cronkite, Dean C Eltzholtz, Clyde R Sipe, William H Chapman and F W Chambers. Naval Medical Research Institute Report No. 16 Aug 19 1948 10p (NP-590)

Available information indicated that rutin, a crystalline rhamnoglucoside of quercetin, favorably influenced the hemorrhagic syndrome of acute ionizing radiation illness in dogs, and accelerated healing of the skin lesions of rats induced by localized radiation injury. A study was therefore made of the effect of rutin on the mortality of acute irradiation illness in mice. Rutin was not only found to be of no value in improving the survival of mice simultaneously exposed to a dose of ionizing radiation in the lethal range, but significantly increased the rate at which the mice died. It is considered desirable to repeat this type of investigation on animals with Vitamin C requirements similar to man.

1127 Ionizing Radiation Injury by Eugene P Cronkite J Amer Med Assoc 139 366-369 (1949) Feb 5

This article is based on Naval Medical Research Institute Report No. 8. An abstract of the report appeared in Nuclear Science Abstracts as abstract No. II-838.

1128 Prevention and Treatment of Radiomucitis (Phrophylaxie et traitment des radiomucites) by René Huguenin, J Fauvet and J Ponthieu Bull Mém Soc Méd Hop Paris 64 983-985 (1948) Oct 22 and 29 (In French)

The mucous membrane almost always responds with a vasculo-inflammatory reaction to the irradiation it receives during the course of radium or X-ray treatment of epitheliomas arising from it or of tumors of other origin, but adjacent to this membrane. This reaction, beyond being a discomfort to the patient, may make it necessary not only to discontinue treatment, but may lead to serious injuries and danger for the patient. In their attempts at prevention and treatment of radiomucitis the authors found that atropine sulfate gave good results in controlling hypersecretion and swelling of the bronchial

RADIATION SICKNESS (continued)

mucous membrane in over 100 cases irradiated for broncho-pulmonary cancers. Daily doses of 0.5 to 1 mg for as long as 8 weeks did not cause any signs of intolerance. The addition 4 times daily of 2.5 mg of pantothenic acid to the atropine sulfate treatment also relieved coughing and dyspnea. Yohimbine chlorhydrate was not effective. For oral and pharyngeal mucitis, penicillin aerosols and intramuscular injections of colloidal silver (electrargol) gave good to remarkable results. Pantothenic acid, nicotinic acid, nicotinamid, and colloidal metals other than copper were not effective. Vesicular and vulvar mucitis, although rare, responded to local applications of RP 3277 (N-(dimethyl aminopropyl) phenothiazine). Electrargol was of little effect in the few cases of intestinal mucitis observed. Opiated lavages were the most effective. All patients undergoing radiotherapy received tincture of belladonna to offset radiation sickness but its effectiveness is not reported. However, good results were obtained by the use of RP 3277.

RADIOACTIVITY

1129 Search for Short-Lived Y, Zr, and Cb Fission Products by Leon J Brown and Seymour Katcoff. AECD-2468 (LADC-569) Aug 13 1948 Decl Feb 14 1949 4p Proposed for publication in J Chem Phys

Collimated fission fragments from a thin Pu foil were allowed to pass through air at 140 mm pressure. By placing a few, very thin, zapon films at the appropriate distances from the Pu, selected fission fragments could be collected completely separated from fragments of greatly differing masses and partially separated from fragments of neighboring mass numbers. Several runs were made using this technique, plus the following chemical operations: one YF_3 precipitation, one $Sr(NO_3)_2$ scavenging precipitation from fuming nitric acid, another YF_3 precipitation, and a final yttrium oxalate precipitation. Counting was begun as soon as 10 minutes after a 5-minute irradiation. In no case was there a shorter lived component than the previously reported 16.5 min Y^{94}. In the case of zirconium, it was found that the range-separation technique offered no advantages over the chemical separation from neutron irradiated solutions of uranium or plutonium. No zirconium isotopes, with half-lives between 3 minutes and 17 hours, were found to result in appreciable yield from fission. The experiments with columbium were performed both with and without the fission recoil apparatus. The chemical purification consisted mainly of repeated Cb_2O_5 precipitations and Bi_2S_3 scavenging precipitations. It was decided that any new Cb fission products with an appreciable yield must have shorter half-lives than 4 minutes.

1130 Characteristics of 16.5-Min Y^{94} by Leon J Brown and Seymour Katcoff. AECD-2469 (LADC-568) Aug 13 1948 Decl Feb 14 1949 7p Proposed for publication in J Chem Phys

During a search for short-lived yttrium fission products it was noted that the half-life of Y^{94} was shorter than the 20-min value reported previously. Therefore a redetermination of the half-life was undertaken. The isotope was isolated from the fission products of uranium and plutonium. From eleven beta decay curves and four gamma decay curves the average value of the half-life was determined as 16.5 ± 1.0 minutes.

1131 The Beta-Ray Spectra of Cu^{64} by C S Wu and R D Albert Phys Rev 75 315-316 (1949) Jan 15 (Letter to the editor)

This article is based on AECD-2403. An abstract of the document has been listed in Nuclear Science Abstracts as Abstract II-282.

1132 The Emission of L Radiation in the Disintegration of ThC and RaD by B B Kinsey Can J Research 26 421-450 (1948) Nov

The amount of L radiation resulting from the K conversion of gamma-radiation emitted in the disintegration of ThB has been measured and found to be in general agreement with the calculations of the preceding paper. [Kinsey Can J Research 26 404-420 (1948) Nov]. This amount, which is determined mainly by the fluorescence yield of the L_3 level, confirms the results of Küstner and Arends

RADIOACTIVITY (continued)

[Ann Physik 91 533 (1934)]; selective absorption measurements confirm the calculated value for the ratio of the fluorescence yields of the L_2 and L_3 levels for the product element (bismuth). The yields of L radiation resulting from the L conversion of the low energy gamma-radiation emitted in the disintegrations of ThC and of RaD have been measured and compared. In the first case the yield is too high, and in the second it is too low compared with the calculated values. Selective absorption measurements indicate that the yields of the L_1 and L_2 levels, taken together, are equal to that of the L_3 level. It is shown that the experimental result for ThC can be explained on the assumption that Auger transitions of the type $L_1 \rightarrow L_2N$ play some part in the distribution of energy in the spectrum; the result for RaD, which is consistent with the results of Stahel (1935), indicates that the low energy gamma-transitions emitted by that element and converting in the L levels are excited in less than 100% of the disintegrations. 44 references.

1133 The Emission of L Radiation Following Internal Conversion of Gamma-Radiation in Heavy Elements by B B Kinsey Can J Research 26 404-420 (1948) Nov

The fluorescence yields of the L levels have been computed separately on the basis of radiation widths obtained from the work of Massey and Burhop, [Proc Cambridge Phil Soc 32 451 (1936)], the widths of Auger transitions of the Coster-Kronig type [Physica 2 870 (1935)] measured by Cooper, [Phys Rev 61 (1942)], and existing information on the widths of the L levels. In the case of fluorescence excitation, the total fluorescence yield calculated in this way is in general agreement with measurements of Lay. In the case of excitation by internal conversion of gamma-radiation in the L levels, it is shown that the total fluorescence yield for elements in the vicinity of tantalum is appreciable less than the yield measured by Lay [Z Physik 91 533 (1934)] for fluorescence excitation, but that for the heavier elements near uranium, the yields should be comparable. Tabulated values are given. 42 references.

1134 Evidence for a New Isotope of Potassium by Roy Overstreet, Louis Jacobson and P R Stout Phys Rev 75 231-233 (1949) Jan 15

This article is based on AECD-2246. An abstract of this document has been listed in Nuclear Science Abstracts as abstract No. I-1184.

1135 Gamma Rays From the Disintegration of Boron by Slow Neutrons by B Rose Can J Research 26 366-378 (1948) Nov

The slow neutron disintegration of B^{10} yields two groups of α-particles, corresponding to the production of Li^7 in either the ground state or an excited state. The gamma-radiation accompanying the de-excitation of the excited nucleus was studied by irradiating boron in the form of boron trifluoride in a proportional counter. Slow neutrons from a Ra-α-Be source were used for the bombardment. Coincidences were counted between α-particle pulses in the proportional counter and gamma-ray pulses in an adjacent Geiger-Müller counter. The ratio of the α-gamma coincidence rate to the α-rate gave the product of the efficiency of the Geiger-Müller counter and the number of quanta emitted per boron disintegration. The absorption coefficient of the gamma-radiation in lead was measured, and by comparison with the absorption coefficients for the gamma-radiation from Cu^{64} and Au^{198}, the energy was found to be 0.48 ± 0.015 Mev. The quantum efficiency of the Geiger-Müller counter for radiation of this energy was determined by calibration with standard sources of Co^{60} and thorium active deposit and the number of quanta per boron disintegration was found to be 0.90 ± 0.08. This value is in satisfactory agreement with the value to be expected from the relative abundance of the α-particle groups from this reaction. 23 references.

1136 Internal Conversion Electrons from Metastable Te^{125} by R D Hill and G Scharff-Goldhaber Phys Rev 75 324 (1949) Jan 15 (Letter to the editor)

The decay of Te^{125} has been studied and the half-life determined as 58 ± 4 days. The conversion electron spectrum obtained with a magnetic β-ray spectrograph, and a part of the microphotometer trace obtained are shown. The average relative intensities of the lines are tabulated; the K/L intensity

RADIOACTIVITY (continued)

ratio was found to be approximately 1.5 while the L/M ratio was about 3.5. Some of the theoretical implications of these data are discussed with respect to Drell's recent calculations (Phys Rev in press).

1137 A Measurement of the Half-Life of Double Beta-Decay from $_{50}Sn^{124}$ by E L Fireman Phys Rev 75 323-324 (1949) Jan 15 (Letter to the editor)

An experimental investigation of Sn^{124} which belongs to isobaric triplet Sn^{124} - Te^{124} - Xe^{124} has been carried out. The experimental arrangement is shown which consisted of an arrangement of coincidence counters shielded by anticoincidence counters and by an Fe and Pb box. The results obtained may be interpreted as indicating that Sn^{124} undergoes double β-decay with a half-life of 0.4 - 0.9×10^{16} yr. This result would seem to indicate that double β-decay is unaccompanied by neutrinos, on the basis of the theoretical calculations [Goeppert-Mayer, Phys Rev 48 512 (1935); Furry, Phys Rev 56 1184 (1939)].

1138 Nuclear Isometry and Capture Levels in Radioactive Bromine $_{35}Br^{80}$ (L'isomérie nucléaire du Radio-Brome Br. $^{80}_{35}$ et ses niveaux de capture) by P C Capron Acad Roy Belg Mém (Sci) 21 3-36 (1948) Fasc 7 (In French)

Activity measurements were made of the product of irradiation of CBr_4 by neutrons from a radium-beryllium source. Ratios were computed between activities measured with and without a cadmium filter, both for the short-lived (17.4 minutes) and the long-lived (4.4 hours) isomers. The inequality of the two ratios was interpreted as an indication of the existence of different capture levels in the compound nucleus. The relative probability of the formation of the metastable isomer grows with the energy of the captured particle. Some unpublished data, obtained by Rajam, are given concerning the activities of the isomers of radiorhodium.

1139 Radiations from Cd^{115}, $*In^{115}$, and Hf^{181} by C E Mandeville, M V Scherb and W B Keighton Phys Rev 75 221-226 (1948) Jan 15

The characteristic radiations of Cd^{115}, $*In^{115}$, and Hf^{181} have been measured by absorption and coincidence methods. The β-γ-coincidence rate of Cd^{115} indicates the presence of an inner β-ray group at 0.46 Mev. Coincidence measurements show that the 4-hour isomer of indium (115) decays with the emission of a single partially converted γ-ray. Hf^{181} was found to emit 0.52 Mev β-rays (aluminum absorption) and 0.17- and 0.47- Mev γ-rays (lead absorption). Beta-gamma-coincidence data indicate that the β-ray spectrum of Hf^{181} could be complex. Beta-beta- and gamma-gamma-coincidence data were also obtained. The purification methods used are described in appendices to the article.

1140 The Radiations from Hf^{181} by K Y Chu and M L Wiedenbeck Phys Rev 75 226-231 (1949) Jan 15

The β-spectrum and photoelectron spectrum of Hf^{181} have been studied with a semicircular focusing β-ray spectrograph of 2% resolving power. In addition to the continuous β-spectrum, four partially converted γ-rays were found. An estimate of the relative intensities of the two higher energy γ-rays can be made from the Compton and photoelectron intensities. Data have also been obtained from β-γ- and β-e^--coincidence measurements. An energy level diagram is discussed.

1141 Radioactivity of C^{10} and O^{14} by R Sherr, H R Muether and M G White Phys Rev 75 282-292 (1949) Jan 15

A new activity, O^{14}, has been produced from N^{14} by a (pn) reaction and is found to decay with a half-life of 76.5 ± 2 sec. by the emission of 1.8 ± 0.1-Mev positrons and a 2.3-Mev γ-ray. Rough threshold measurements indicate that the γ- and β-rays are in cascade. C^{10}, formed by a (pn) reaction in B^{10}, has been carefully reexamined and shown to decay with a half-life of 19.1 ± 0.8 sec. by the emission of 2.2 ± 0.1-Mev positrons and a γ-ray of approximately 1 Mev. The Coulomb energy formula for this type of mirror nucleus is shown to be valid, but the same theoretical difficulties are encountered here as are already known from the long lives of Be^{10} and C^{14}.

RADIOACTIVITY (continued)

1142 Screening and Relativistic Effects on Beta-Spectra by C Longmire and H Brown Phys Rev 75 264-270 (1949) Jan 15

This article is based on AECD-2347. An abstract of this document has been listed in Nuclear Science Abstracts as abstract No. I-1699.

1143 Search For A 3.20 Mev. Gamma-Ray in the Disintegration of Thorium C'' by R E Bell and L G Elliott Can J Research 26 379-385 (1948) Nov

In about 70% of the disintegrations, thorium C'' transforms to the ground state of throium D by the emission of a β-ray and two successive gamma-rays of energy 0.58 and 2.62 Mev. A search has been made for a gamma-ray of energy 3.20 Mev which would be emitted if a single radiative transition occurred. Using a source of radiothorium in equilibrium with its decay products, the secondary electrons ejected by the gamma-rays from thin radiators of lead and uranium were analyzed in a magnetic lens spectrometer. No photoelectrons ejected by a 3.20 Mev gamma-ray were observed. If the gamma-ray occurs its intensity is less than 0.2% of the intensity of the gamma-ray at 2.62 Mev. This result is discussed in the light of the proposed disintegration schemes of thorium C''.

1144 Three Additional Collateral Alpha-Decay Chains by W W Meinke, A Ghiorso and G T Seaborg Phys Rev 75 314-315 (1949) Jan 15 (Letter to the editor)

Continuation of investigations of the type which led to the observation of artificial radioactive chains collateral to the natural thorium and actinium families [Phys Rev 74 695 (1948)] have led to the identification of an additional collateral chain and partial identification of two others. The isotopes U^{229}, U^{228}, and Pa^{226} have been observed to decay to Bi^{209}, Pb^{208}, and Pb^{206}, respectively, by a series of α-emissions for the most part. The measured half-lives and the nature and energies of the radiations are shown in tabular form along with the latest data for the previously reported Pa^{227} and Pa^{228} collateral chains.

RADIOGRAPHY

1145 Radiology Physics, 2nd ed., by J K Robertson. New York, Van Nostrand 1948 323p

This book is intended primarily as an introductory course for medical or premedical students and for radiologists. The text is arranged according to the following chapters: Alternating Currents, Production of High Voltage, Cathode Rays, Positive Rays and Isotopes, Roentgen Tubes, Valve Rectification, High Frequency Currents, Visible and Invisible Light, General Properties of X-Rays, Measurement of Wave Length of X-Rays, Secondary X-Rays and Absorption, Roentgen Ray Dosages, Radioactivity, Super-voltage Tubes and High Speed Particles, Transmutation of Matter and Neutrons, Artificial Radioactivity, Mass and Energy, Uranium Fission and Atomic Piles. One of the appendices contains the international recommendations for X-Ray and radium protection.

RADIOTHERAPY

1146 Extravesical Radium Therapy in Cancer of the Bladder by R Ogier Ward Brit J Urol 20 191-202 (1948) Dec

A new technique for radium treatment of malignant bladder growths is described, the essential of which is that the needles are placed in position in the outer layers of the bladder wall corresponding to the growth, without the performance of cystostomy and without penetration of the bladder cavity. Careful preliminary investigations and accurate cystoscopic examination are essential. Five cases are described, in 2 of them extensive highly malignant growths have disappeared and the patients are free of symptoms 9 months and 4 months after treatment. Two cases died. In one case a large portion of the growth within the bladder was destroyed, but the extravesical part was little affected and has since increased.

RADIOTHERAPY (continued)

1147 Use of Roentgen Therapy for Retinal Diseases Characterized by New-Formed Blood Vessels by Jack S Guyton and Algernon B Reese Arch Ophthalmol 40 389-407 (1948) Oct

Intensive roentgen therapy to the posterior ocular segment was given during the 18 months prior to this report in a series of patients with ocular diseases characterized by retinal and vitreous hemorrhages and by new-formed blood vessels and fibrous tissue extending from the retina or disk into the vitreous (retinitis proliferans). A total of 22 eyes in 14 patients were treated. The ocular diseases were classified as typical Eales's disease, in 8 patients: atypical Eales's disease, in 4 patients, and diabetic retinitis proliferans, in 2 patients. The irradiation technic devised by Martin and Reese [Arch Ophthalmol 33 429-439 (1945)] for the treatment of retinoblastoma was utilized to avoid damage to the anterior ocular segment. A total dose of 3,500 to 15,000 r was given each eye treated. Doses of approximately 6,000 r are probably optimal.

Depending on the dose of roentgen radiation given, there were moderate to complete collapse of new-formed vessels and variable regression of fibrosis. There has been only one recurrent hemorrhage following treatment in the 8 cases of typical Eales's disease, an effect which has appeared to be of immediate significance, but the permanency of these immediate results is not established because sufficient time has not elapsed since the patients were treated. In the 2 patients with diabetic retinitis proliferans, hemorrhages have continued to appear since treatment, and permanent beneficial results can hardly be expected.

RARE EARTHS AND COMPOUNDS

1148 The Isotopic Constitution of Ytterbium by Richard J Hayden, David C Hess, Jr and Mark G Inghram Phys Rev 75 322-323 (1949) Jan 15 (Letter to the editor)

An electrometric determination of the isotopic abundances of ytterbium isotopes has been made. The ion source used was a tungsten surface ionization filament similar to that previously used for the mass determination of active isotopes [Hayden Phys Rev 74 650 (1948)], the instrument and techniques used have also been previously described [Phys Rev 72 967 (1947)]. The values obtained for two samples are compared in tabular form with those obtained by Aston [Nature 133 327 (1934); Proc Roy Soc 146A 46 (1934)], Dempster [Phys Rev 53 727 (1938)] and Wahl [Naturwissenschaften 29 536 (1941)]. The following upper limits for the natural occurrence of other isotopes of ytterbium were set: $Yb^{166} < 0.002\%$, $Yb^{167} < 0.002\%$, $Yb^{169} < 0.01\%$, $Yb^{175} < 0.02\%$, $Yb^{177} < 0.01\%$, $Yb^{178} < 0.002\%$. With the assumption of zero packing fraction for the ytterbium isotopes the chemical atomic weight of ytterbium calculated from the new abundances is 173.046 ± 0.006.

SCIENTIFIC RESEARCH AND LABORATORIES

1149 Recent Trends in American Physical Science by C J Overbeck J Sci Instruments 26 1-12 (1949) Jan

The author reviews the recent progress in physics research. Included in the topics summarized are the following: artificial and high altitude mesons, thermal neutron velocity selector, neutron and electron interaction, nuclear resonance absorption, and leak detection by the mass spectrometer. 29 figures. 21 references.

TRACER APPLICATIONS - BIOLOGY

1150 Calcium Exchange as the Mechanism for Adsorption of the Radioactive Isotopes by Bone by Marlene Falkenheim, Elizabeth E Underwood and Harold C Hodge. AECU-95 (UR-53) Dec 1 1948 20p

In vitro experiments, in which powdered bone ash was exposed to solutions of calcium chloride containing Ca^{45}, have shown that bone exchanges calcium with the solution. The Ca^{45} concentration rises rapidly until it reaches a "quasi-equilibrium". The exchangeable bone-calcium represents at the most, less than 20% of the total bone calcium; this fraction is of the same order of magnitude as

TRACER APPLICATIONS - BIOLOGY (continued)

that previously reported for the exchangeable bone phosphate. This reaction is reversible to the same "quasi-equilibrium" point.

1151 Advances in Enzymology, v. 7 ed. by F F Nord. New York, Interscience Publishers 1947 665p

Of particular interest in the field of tracer applications is the section entitled "Some Applications of Radioactive Indicators in Turnover Studies", by G. Hevesy. The following topics are discussed in this section: Turnover of phosphorus containing carbohydrates, phosphatides, and nucleic acids; phosphorus turnover in cell nuclei and leukemic tissue; intravenous transfer of P^{32} from chromatin to hepatic tissue; phosphorus turnover in yeast; studies of virus reproduction; dynamic state of body constituents; turnover of sulfur compounds; and role of iodine in thyroid metabolism.

Other sections are: Permeability and Enzyme Reactions, by S. C. Brooks; Properties of Protoplasm with Special Reference to the Influence of Enzymic Reactions, by William Seifriz; Recent Views on Asymmetric Syntheses and Related Processes, by P. D. Ritchie; Bacterial Luminescence, by F. H. Johnson; Heme-linked Groups and Modes of Action of Some Hemoproteins, by Hugo Theorell; Distribution, Structure, and Properties of Tetrapyrroles, by S. Granick and H. Gilder; Oxidation of Organic Sulfur in Animals, by Claude Fromageot; Interrelation in Microorganisms between Growth and the Metabolism of Vitamin-like Substances, by Henry McIlwain; Antibacterial Substances from Fungi and Green Plants, by Frederick Kavanagh; Kidney Enzymes and Essential Hypertension, by Otto Schales; and Recent Progress in Industrial Fermentation, by F. M. Hildebrandt.

1152 Determination of Circulating Red Blood Cell Volume with Radioactive Phosphorus by Robert T Nieset, Blanche Porter, W V Trautman, Jr, Ralph M Bell, William Parson, Champ Lyons and H S Mayerson Amer J Physiol 155 226-231 (1948) Nov

A method for the direct measurement of total circulating red blood cell volume by an isotope dilution technic using P^{32} is presented. The red cells from the subject of study are utilized for labelling. The total circulating volume of red blood cells is calculated from the formula: mls of red blood cells = $\frac{\text{Total counts/sec injected}}{\text{Counts/sec/ml of cells withdrawn}}$. Rapid uptake and slow release of P^{32} by exposed red cells facilitates wide experimental application. Ease of counting and the opportunity for repetitive measurement are other advantages.

1153 The Internal Metabolism of Cobalt and Copper as Studied with Their Radioactive Isotopes by C L Comar [In "Proceedings of the Auburn Conference on the Use of Radioactive Isotopes in Agricultural Research, Dec 18-20 1947," Auburn, The Alabama Polytechnic Institute, 137-146 (1948)]

A specific application of radioactive tracer methodology to agricultural and biochemical problems is described. By the use of isotopes it is shown that the major function of cobalt in the ruminant is an external function in the rumen since injected cobalt is not effective therapeutically and does not reach the rumen contents in significant amounts. Although no differences are apparent in the internal metabolism of cobalt in cattle, rabbits, rats, and swine, cobalt deficiency is not observed as yet in the non-ruminant. Cobalt must be supplied continuously in the diet to maintain normal health for ruminants since the animals do not store it. This is true, in lesser degree, for copper. However, newly born calves have enough accumulated cobalt to fill their needs until the rumen begins to function. There is no direct evidence of a normal hemopoietic function for cobalt although it is able to produce polycythemia. Tables of excretion and of tissue distribution of orally administered and of intravenously injected copper and cobalt are given. The chief differences in the internal metabolism of cobalt and copper are: (1) The lack of general distribution of dietary cobalt in the adult, (2) the high selective accumulation of copper in the liver of the young animal, (3) the high retention of intravenously injected copper and (4) the absorption of copper by the red blood cells.

TRACER APPLICATIONS - BIOLOGY (continued)

1154 Radioactivity and Radioisotopes by Fred Allison [In "Proceedings of the Auburn Conference on the Use of Radioactive Isotopes in Agricultural Research, Dec 18-20 1947," Auburn, Alabama Polytechnic Institute, 7-22 (1948)]

The purpose of this paper is to present some basic facts and principles of radioactivity and radioisotopes. It is not meant primarily for physicists, but rather for workers in adjacent fields of science.

1155 The Significance of the Radioactive and Heavy Carbon Isotopes in Fermentation Biology (Die Bedeutung der radioaktiven und schweren Kohlenstoffisotope für die Gärungsbiologie) by Torsten Wiken Iva 19 201-215 (1948) (In German)

The author reviews the work done in the investigation of fermentation processes using isotope techniques. The first work was reported by Hevsey in 1923, and was followed by investigations of the true mechanism of methane formation as well as the reasons why no longer chains were produced. Other fermentation processes were investigated and the results are summarized in the article. 76 references.

1156 Some Biological and Medical Uses of Radioactive Isotopes by D Harold Copp [In "Proceedings of the Auburn Conference on the Use of Radioactive Isotopes in Agricultural Research, Dec 18-20 1947," Auburn, The Alabama Polytechnic Institute, 124-128 (1948)]

Some of the useful applications of radioactive iodine, sodium, iron, carbon, strontium, calcium, and phosphorus are reviewed.

1157 Studies on the Formation of Organically-Bound Iodine Compounds in the Thyroid Gland and Their Appearance in Plasma as Shown by the Use of Radioactive Iodine by I L Chaikoff and Alvin Taurog Ann New York Acad Sci 50 377-400 (1949) Jan 27

The authors review the recent work on thyroxine and diiodothyroxine formation in the thyroid gland of normal and hypophysectomized animals that has been made possible through the introduction of radioactive iodine and the development of micro-methods for the measurements of iodine and thyroxine. Other topics considered are: studies with surviving slices of thyroid tissue, the mechanism of iodine fixation, circulating iodine, and the effect of thyrotropic hormone. Data are presented in 10 tables and 9 figures. 47 references.

1158 Use of Radioactive Hydrogen for Measurement in Vivo of Total Body Water by Nello Pace, Leo Kline, Howard K Schachman and Morton Harfenist. Naval Medical Research Institute Report No. 5 Nov 14 1946 16p

The problem of in vivo determination of total body water in man was approached using the radioactive isotope of hydrogen (tritium) in the form of water. The tritium was obtained by cyclotron bombardment of beryllium and was then converted to water. A method was developed for the determination of the activity of this water. This involved modification of the Geiger-Muller counter tube so as to permit introduction into the tube of measured amounts of radioactive water vapor, alcohol and argon. The tube was evacuated and rinsed before each determination. Water of known activity was injected into two rabbits and one man, and the plasma activity determined after a period of equilibrium (close to one hour in the man). The body water of the human subject determined in this way agreed to within less than 1 per cent with the value calculated from specific gravity, assuming body water to constitute 73.2 per cent of the lean body mass. The values obtained for the two rabbits agreed to within less than 5 per cent with water content determined by desiccation and weighing.

TRACER APPLICATIONS - PHYSICS

1159 Thermal Exchange Experiments with Radioactive Chromium by H E Menker and C S Garner J Amer Chem Soc 71 371-372 (1949) Jan

The authors have confirmed the observation of Muxart, Daudel, Daudel, and Haissinsky [Nature 159 538 (1947)] that no appreciable exchange of radiochromium occurs between chromium (III) and dichromate ions in sulfuric acid solutions and have extended the studies to exchange measurements in 2 f and 0.05 f perchloric acid and in 3.1 f sodium hydroxide as well as with hexathiocyanatochromate (III), hexacyanochromate (III), and trioxalatochromate (III) ions. A table of results is presented.

1160 Thermal Exchange Experiments with Radioactive Zinc by Leon Leventhal and C S Garner J Amer Chem Soc 71 371 (1949) Jan

Thermal exchange reactions of zinc ions with some zinc complex compounds have been examined in order to find conditions under which the kinetics of such reactions might be studied and to learn which of these zinc compounds might be suitable for use in the Szilard-Chalmers method of concentrating isotopes. Complete exchange of radioactive zinc was found between dipyridine zinc acetate and the following compounds of zinc in pyridine solution at 25°C after exchange times as short as 30 sec: acetylacetone, acetylacetone ethylenediimine, benzoylacetone ammoniate, nicotinylacetone, and dipyridine zinc thiocyanate. It seems that rapid exchange was induced by the separation procedure utilized, or that the zinc complex compounds are comparatively unstable with respect to ionization or displacement reactions. If the exchange was not induced, the compounds are not suitable for Szilard-Chalmers separations.

URANIUM AND URANIUM COMPOUNDS

1161 Chemistry of Aqueous Uranium (V) Solutions - I. Preparation and Properties. Analogy between U(V), Np(V) and Pu(V) by K A Kraus, G L Johnson and F Nelson. AECD-2460 (ORNL-188) Dec 15 1948 Decl Jan 18 1949 33p

Aqueous solutions of U(V) of considerable stability have been prepared and studied. Additional evidence for the formula $UO_2(H_2O)_m^+$ for U(V) is presented. Through consideration of potential and hydrolytic data of uranium and the transuranic elements, predictions regarding the thermodynamic stability of the plus-five oxidation states of these elements can be made. It is shown that they have an optimum stability range between pH 2 and 5.

1162 Uranium and Hydrogen Functions of Uranium Glass Electrodes by H W Alter, T W Newton and C E Larson. AECD-2467 (C-0.385.6 Revised) Feb 4 1946 Decl Feb 2 1949 17p

Experiments with a special hard glass of low electrical resistance containing UO_3, and with canary glass, fail to show any uranium electrode function for these types of glass.

1163 Condensation of Basic Ions in the Hydrolysis of Aluminum and Uranyl Nitrates (Sur la condensation des ions basiques dans l'hydrolyse des nitrates d'aluminium et d'uranyle) by Jacques Faucherre Compt Rend 227 1367-1369 (1948) Dec 20 (In French)

In a previous work [Geloso and Faucherre Compt Rend 227 200 (1948)] it was shown that, by dilution at constant ionic strength, the pH of hydrolysis of a pure salt varies according to the relation $d\,pH/d\,\log V = n/(q+1)$, where V is dilution, q the number of H^+ ions involved, and n the condensation degree of basic ions. When applied to the hydrolysis of uranyl nitrate, the above formula is replaced by $d\,pH/d\,\log(c - [H^+]) = -n/(q+1)$, where c is the original salt concentration, and $[H^+]$ the ion activity of H^+. This theory indicates a condensation in pairs of the basic ion ($2\,UO_2^{++} + 2H_2O \rightleftharpoons (UO_2^{++}OH)_2 + 2H^+$) for c lying between 2.10^{-1} and 1.10^{-4}. This result agrees with the experimental data on neutralization of uranyl nitrate [Faucherre and Schall Bull Soc Chim France 14 927 (1947)].

VACUUM SYSTEMS

1164 The Physical Principles of Vacuum Measurement and Production by C H Bachman Instruments 22 33-36 (1949) Jan

The production of various degrees of vacuum is discussed; pumps and pressure gages suitable for use at low pressures are described.